(19) JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

(11) Publication number: **2000130157 A**

(43) Date of publication of application: **09.05.00**

(51) Int. Cl **F01N 3/24**
B01D 53/86
F01N 3/08
F01N 3/20
F02D 41/04
F02D 43/00

(21) Application number: **10303894**

(22) Date of filing: **26.10.98**

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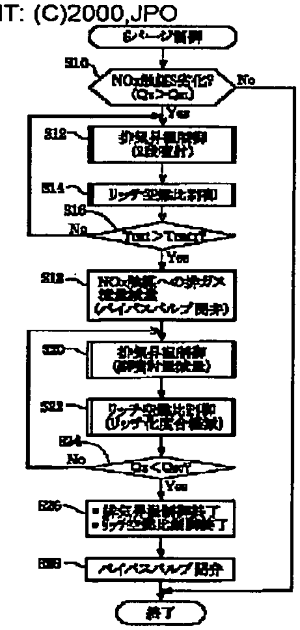
(54) EXHAUST EMISSION CONTROL DEVICE FOR INTERNAL COMBUSTION ENGINE

(57) Abstract:

PROBLEM TO BE SOLVED: To provide an exhaust emission control device for an internal combustion engine which can restrain the deterioration of a fuel consumption and drivability and release a sulphur component efficiently and surely.

SOLUTION: This exhaust emission control device for an internal combustion engine is provided in an exhaust gas passage and provided with a catalyst absorbing the sulphur component in an exhaust gas under a first operation state in which an exhaust air fuel ratio is an oxydation atmosphere and releasing the sulphur component absorbed under a second operation state in which a high temperature and exhaust air fuel ratio are a restoration atmosphere. In that device, in a second operation state (S12, S14), the exhaust flow rate poured in the catalyst by a flow rate reduction means is properly reduced (S18). Therefore, even if the exhaust temperature and exhaust air fuel ratio are changed (S20, S22), the catalyst is held in the high temperature and restoration atmosphere.



(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号
特開2000－130157
（P2000－130157A）
(43)公開日　平成12年5月9日(2000.5.9)

(51)Int.Cl.⁷	識別記号	ＦＩ		テーマコード*(参考)
Ｆ０１Ｎ　3/24		Ｆ０１Ｎ　3/24	Ｒ	３Ｇ０８４
Ｂ０１Ｄ　53/86	ＺＡＢ	3/08	Ａ	３Ｇ０９１
Ｆ０１Ｎ　3/08		3/20	Ｅ	４Ｄ０４８
3/20			Ｎ	
		Ｆ０２Ｄ　41/04　３０５Ａ		

審査請求　未請求　請求項の数１　ＯＬ　（全　７　頁）

最終頁に続く

(21)出願番号　特願平10－303894

(22)出願日　平成10年10月26日(1998.10.26)

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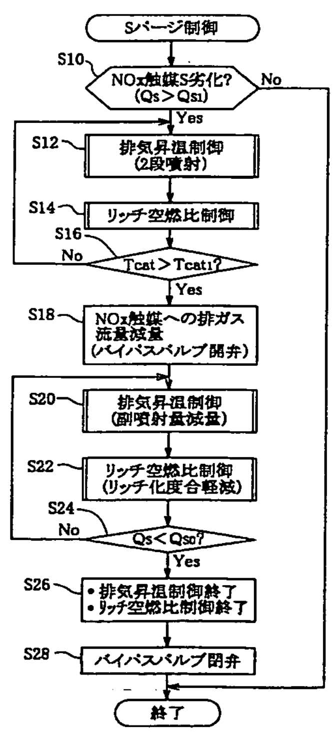
(54)【発明の名称】　内燃機関の排気浄化装置

(57)【要約】
【課題】　燃費やドライバビリティの悪化を抑えて効率良く確実に硫黄成分を放出可能な内燃機関の排気浄化装置を提供する。
【解決手段】　排気通路に設けられ、排気空燃比が酸化雰囲気となる第１運転状態で排気中の硫黄成分を吸蔵し、高温且つ排気空燃比が還元雰囲気となる第２運転状態の下に吸蔵した硫黄成分を放出する触媒を備えた内燃機関の排気浄化装置において、第２運転状態(S12, S14)のときには、流量減量手段によって触媒に流入する排気流量が適宜減量させられ(S18)、故に、排気温度や排気空燃比を変化させても(S20, S22)、触媒は高温且つ還元雰囲気に保持される。



1

【特許請求の範囲】

【請求項１】　排気通路に設けられ、排気空燃比が酸化雰囲気となる第１運転状態で排気中の硫黄成分を吸蔵し、高温且つ排気空燃比が還元雰囲気となる第２運転状態で前記吸蔵した硫黄成分を放出する触媒と、

前記第２運転状態のとき、前記触媒に流入する排気流量を減量する流量減量手段と、

を備えたことを特徴とする内燃機関の排気浄化装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、内燃機関の排気浄化装置に係り、詳しくは、触媒に吸蔵された硫黄酸化物（ＳＯx）を除去する技術に関する。

【０００２】

【関連する背景技術】一般に、燃料中にはＳ（サルファ）成分（硫黄成分）が含まれており、このＳ成分は酸素と反応してＳＯx（硫黄酸化物）となり、該ＳＯxは硫酸塩Ｘ－SO_4として排気浄化触媒に吸蔵される（Ｓ被毒）。例えば、吸蔵型ＮＯx触媒の場合には、排気空燃比がリーン空燃比（酸化雰囲気）のときにおいて排ガス中のＮＯxとともにＳＯxを吸蔵してしまい、触媒のＮＯx浄化機能が低下するという問題がある。

【０００３】そこで、このようにＳＯxが吸蔵型ＮＯx触媒に吸蔵された場合、触媒を排気昇温制御（例えば、点火時期のリタード）により所定の高温とし且つ触媒周辺の排気空燃比をリッチ空燃比（酸素濃度が低下した還元雰囲気）とすることで当該吸蔵されたＳＯxを放出する技術（Ｓ放出制御）が特開平７－２１７４７４号公報等により公知である。

【０００４】

【発明が解決しようとする課題】ところで、上記公報（特開平７－２１７４７４号公報）に開示された技術では、Ｓ放出制御中には、触媒温度を常に上記所定の高温に保持しておく必要性から、吸蔵されたＳＯxが放出されるまで排気昇温制御を継続している。しかしながら、このように排気昇温制御（点火時期のリタード等）を長期間に亘り継続することは、内燃機関本来の出力を低下させることになるため、燃費の悪化、及びドライバビリティの悪化に繋がり好ましいことではない。

【０００５】そこで、排気昇温制御の実施期間を短縮することが考えられるが、上記公報に開示された構成では、排ガスが常に吸蔵型ＮＯx触媒を通るように構成されているため、単に排気昇温制御の実施期間を縮めただけでは、排気昇温制御の終了によって排ガスの温度が低下して触媒温度が低下し、触媒温度を十分に上記所定の高温に保持できないという問題がある。特に、排気量の大きい内燃機関のように排ガス流量が多いような状況下では、当該温度の低下した多量の排ガスの流れによって一旦所定温度にまで昇温した触媒が急速に冷却されることになり、吸蔵されたＳＯxが完全に放出されないままにＳ放出制御が終了してしまうおそれがあり好ましいことではない。

2

【０００６】本発明はこのような問題点を解決するためになされたもので、その目的とするところは、燃費やドライバビリティの悪化を抑えて効率良く確実に硫黄成分を放出可能な内燃機関の排気浄化装置を提供することにある。

【０００７】

【課題を解決するための手段】上記した目的を達成するために、請求項１の発明によれば、排気通路に設けられ、排気空燃比が酸化雰囲気となる第１運転状態で排気中の硫黄成分を吸蔵し、高温且つ排気空燃比が還元雰囲気となる第２運転状態の下に吸蔵した硫黄成分を放出する触媒を備えた内燃機関の排気浄化装置において、第２運転状態のときには、流量減量手段によって触媒に流入する排気流量が適宜減量させせられる。

【０００８】例えば、第２運転状態が開始された後、触媒が所定の高温になると、触媒に流入する排気流量が減量させられて触媒に排ガスが流れ難くされる。このように触媒に排ガスが殆ど流れないようにされると、通常、第２運転状態では、触媒を高温にすべく点火時期のリタード等を行って排気温度を上昇させ、排気空燃比を還元雰囲気とすべく空燃比をリッチ空燃比にするのであるが、これら点火時期のリタード量やリッチ空燃比の度合を小さく抑え、排ガスの温度を低下させるよう操作しても、当該低温の排ガス流によって触媒が冷却されてしまうことが殆どなくなり、触媒は暫時良好に所定の高温に保持され、排気空燃比は良好に還元雰囲気に保持される。

【０００９】この場合、第２運転状態では点火時期のリタード等により内燃機関本来の出力が低下するとともに空燃比のリッチ空燃比化により燃料供給量が増加して燃費やドライバビリティが悪化する傾向にあるのであるが、当該第２運転状態での運転期間を触媒が所定の高温になるまでの必要且つ十分な期間に抑えることができ、燃費やドライバビリティの悪化を防止しながら、触媒に吸蔵された硫黄成分を効率よく確実に放出可能となる。

【００１０】好ましくは、例えば、第２運転状態が開始された後、触媒が所定の高温になると、触媒に流入する排気流を一切遮断するのがよく、このようにすれば、内燃機関の運転状態を通常の運転状態に戻すようにもでき、燃費やドライバビリティの悪化をより一層好適に防止しながら、触媒に吸蔵された硫黄成分を効率よく確実に放出可能となる。

【００１１】

【発明の実施の形態】以下、本発明の一実施形態を添付図面に基づき説明する。図１を参照すると、車両に搭載された本発明に係る内燃機関の排気浄化装置の概略構成図が示されており、以下同図に基づいて本発明に係る排気浄化装置の構成を説明する。

3

【００１２】機関本体（以下、単にエンジンという）１は、例えば、燃料噴射モード（運転モード）を切換えることで吸気行程での燃料噴射（吸気行程噴射モード）または圧縮行程での燃料噴射（圧縮行程噴射モード）を実施可能な筒内噴射型火花点火式直列４気筒ガソリンエンジンとされている。そして、この筒内噴射型のエンジン１は、容易にして理論空燃比（ストイキオ）での運転やリッチ空燃比での運転（リッチ空燃比運転）の他、リーン空燃比での運転（リーン空燃比運転）が実現可能とされており、特に圧縮行程噴射モードでは、超リーン空燃比での運転が可能とされている。

【００１３】同図に示すように、エンジン１のシリンダヘッド２には、各気筒毎に点火プラグ４とともに電磁式の燃料噴射弁６が取り付けられており、これにより、燃焼室８内に燃料を直接噴射可能とされている。そして、燃料噴射弁６には、燃料パイプを介して燃料タンクを擁した燃料供給装置（共に図示せず）が接続されている。

【００１４】さらに、シリンダヘッド２には、各気筒毎に略直立方向に吸気ポートが形成されており、各吸気ポートと連通するようにして吸気マニホールド１０の一端がそれぞれ接続されている。そして、吸気マニホールド１０の他端にはスロットル弁１１が接続されており、該スロットル弁１１にはスロットル開度θthを検出するスロットルポジションセンサ（ＴＰＳ）１１ａが設けられている。

【００１５】また、シリンダヘッド２には、各気筒毎に略水平方向に排気ポートが形成されており、各排気ポートと連通するようにして排気マニホールド１２の一端がそれぞれ接続されている。図中符号１３は、クランク角を検出するクランク角センサであり、該クランク角センサ１３はエンジン回転速度Neを検出可能とされている。

【００１６】なお、当該筒内噴射型のエンジン１は既に公知のものであり、その構成の詳細についてはここでは説明を省略する。同図に示すように、排気マニホールド１２には排気管（排気通路）１４が接続されており、この排気管１４にはエンジン１に近接した小型の近接三元触媒２０、吸蔵型ＮＯx触媒３０及び三元触媒３２を介してマフラー（図示せず）が接続されている。また、排気管１４の吸蔵型ＮＯx触媒３０上流部には排気温度を検出する高温センサ１６が設けられている。

【００１７】また、排ガスが吸蔵型ＮＯx触媒３０を迂回するようにしてバイパス通路３４が設けられており、バイパス通路３４の排気管１４からの分岐部には、バイパス通路３４へ流入する排ガス流量と吸蔵型ＮＯx触媒３０へ流入する排ガス流量との比率を調節するバタフライ式のバイパスバルブ３６が配設されている。このバイパスバルブ３６はソレノイド３８によって開閉作動可能とされている。

【００１８】吸蔵型ＮＯx触媒３０は、酸化雰囲気においてNO_xを一旦吸蔵させ、主としてＣＯの存在する還元雰囲気中においてNO_xをN_2（窒素）等に還元させる機能を持つものである。詳しくは、吸蔵型ＮＯx触媒３０は、貴金属として白金（Ｐｔ），ロジウム（Ｒｈ）等を有した触媒として構成されており、吸蔵材としてはバリウム（Ｂａ）等のアルカリ金属、アルカリ土類金属が採用されている。

4

【００１９】さらに、入出力装置、記憶装置（ＲＯＭ、ＲＡＭ、不揮発性ＲＡＭ等）、中央処理装置（ＣＰＵ）、タイマカウンタ等を備えたＥＣＵ（電子コントロールユニット）４０が設置されており、このＥＣＵ４０により、本発明に係る内燃機関の排気浄化装置の総合的な制御が行われる。ＥＣＵ４０の入力側には、上述したＴＰＳ１１ａ、クランク角センサ１３や高温センサ１６等の各種センサ類が接続されており、これらセンサ類からの検出情報が入力する。

【００２０】一方、ＥＣＵ４０の出力側には、点火コイルを介して上述した点火プラグ４や燃料噴射弁６等が接続されており、これら点火コイル、燃料噴射弁６等には、各種センサ類からの検出情報に基づき演算された燃料噴射量や点火時期等の最適値がそれぞれ出力される。これにより、燃料噴射弁６から適正量の燃料が適正なタイミングで噴射され、点火プラグ４によって適正なタイミングで点火が実施される。

【００２１】ところで、ＥＣＵ４０では、ＴＰＳ１１ａからのスロットル開度情報θthとクランク角センサ１３からのエンジン回転速度情報Neとに基づいてエンジン負荷に対応する目標筒内圧、即ち目標平均有効圧Ｐeを求めるようにされており、さらに、当該目標平均有効圧ＰeとエンジンHUGE回転速度情報Neとに応じてマップ（図示せず）より燃料噴射モードを設定するようにされている。例えば、目標平均有効圧Ｐeとエンジン回転速度Neとが共に小さいときには、燃料噴射モードは圧縮行程噴射モードとされ、燃料は圧縮行程で噴射され、一方、目標平均有効圧Ｐeが大きくなり或いはエンジン回転速度Neが大きくなると燃料噴射モードは吸気行程噴射モードとされ、燃料は吸気行程で噴射される。吸気行程噴射モードには、リーン空燃比とされる吸気リーンモード、理論空燃比とされるストイキオフィードバックモード、及び、リッチ空燃比とされるオープンループモードとがある。

【００２２】そして、目標平均有効圧Ｐeとエンジン回転速度Neとから制御目標となる目標空燃比（目標Ａ／Ｆ）が設定され、上記適正量の燃料噴射量は該目標Ａ／Ｆに基づいて決定される。上記高温センサ１６により検出された排気温度情報からは触媒温度Ｔcatが推定される。詳しくは、高温センサ１６を吸蔵型ＮＯx触媒３０に直接設置できないことに起因して発生する誤差を補正するために、目標平均有効圧Ｐeとエンジン回転速度情報Neとに応じて予め実験等により温度差マップ（図示

せず）が定められており、触媒温度Ｔcatは当該温度差マップと排気流量情報（吸入空気量情報）等に基づいて推定されるようになっている。

【００２３】以下、このように構成された排気浄化装置の本発明に係る作用について説明する。つまり、吸蔵型ＮＯx触媒３０には、上述したようにリーン空燃比運転時（第１運転状態）においてＳＯxも吸蔵され、Ｓ（サルファ）パージ制御（Ｓ放出制御）により当該ＳＯxを除去するのであるが、以下、本発明に係るＳパージ制御について説明する。

【００２４】図２を参照すると、本発明に係るＳパージ制御ルーチンのフローチャートが示されており、以下当該フローチャートに沿って説明する。先ず、ステップＳ１０では、ＮＯx触媒がＳ（サルファ）劣化したか否か、即ち吸蔵型ＮＯx触媒３０に吸蔵されたＳＯxの量（被毒Ｓ量Ｑs）が所定量Ｑs1よりも大きい（Ｑs＞Ｑs1）か否かを判別する。ここに、被毒Ｓ量Ｑsは推定により求められる値である。以下、被毒Ｓ量Ｑsの推定手法について簡単に説明する。

【００２５】被毒Ｓ量Ｑsは、基本的には燃料噴射積算量Ｑfに基づき設定されるものであり、燃料噴射制御ルーチン（図示せず）の実行周期毎に次式により演算される。

$$Qs = Qs(n-1) + \Delta Qf \cdot K - Rs \quad \cdots (1)$$

ここに、Ｑs(n-1)は被毒Ｓ量の前回値であり、ΔＱfは実行周期当たりの燃料噴射積算量、Ｋは補正係数、Ｒsは実行周期当たりの放出Ｓ量を示している。

【００２６】つまり、現在の被毒Ｓ量Ｑsは、実行周期当たりの燃料噴射積算量ΔＱfを補正係数Ｋで補正して積算するとともに、該積算値から実行周期当たりの放出Ｓ量Ｒsを減算することで求められる。補正係数Ｋは、例えば、次式(2)に示すように、空燃比Ａ／Ｆに応じたＳ被毒係数Ｋ1、燃料中のＳ含有量に応じたＳ被毒係数Ｋ2及び触媒温度Ｔcatに応じたＳ被毒係数Ｋ3の３つの補正係数の積からなっている。

【００２７】$K = K1 \cdot K2 \cdot K3 \quad \cdots (2)$

また、実行周期当たりの放出Ｓ量Ｒsは次式(3)から演算される。

$$Rs = \alpha \cdot R1 \cdot R2 \cdot dT \quad \cdots (3)$$

ここに、αは単位時間当たりの放出率（設定値）であり、ｄＴは燃料噴射制御ルーチンの実行周期を示しており、Ｒ1及びＲ2はそれぞれ触媒温度Ｔcatに応じた放出能力係数及び空燃比Ａ／Ｆに応じた放出能力係数を示している。

【００２８】ステップＳ１０の判別結果が偽（Ｎｏ）の場合には、Ｓパージを行う必要がないため、何もせずに当該ルーチンを抜ける。一方、判別結果が真（Ｙｅｓ）で、被毒Ｓ量Ｑsが所定量Ｑs1を超え、ＮＯx触媒がＳ劣化したと判定された場合には、次にステップＳ１２に進み、Ｓパージを開始する。ステップＳ１２では、吸蔵型ＮＯx触媒３０を昇温させるべく、排気昇温制御を行う（第２運転状態）。実際には、ここでは、２段噴射（複数回噴射）を行う。つまり、吸気行程または圧縮行程中に主燃焼の主噴射を行うとともに、膨張行程中に副噴射を行い、副噴射による未燃燃料成分（ＨＣ等）を排ガスの熱により排気管１４内で燃焼させることで排気昇温を行い、吸蔵型ＮＯx触媒３０を昇温させるようにする。なお、この排気昇温制御は上述したように点火時期のリタードであってもよく、点火時期のリタードでも２段噴射と同様の昇温効果が得られる。また、２段噴射と点火時期のリタードを併用するようにしてもよい。

【００２９】そして、次のステップＳ１４では、吸蔵型ＮＯx触媒３０を酸素濃度が低下した還元雰囲気にすべく、目標Ａ／Ｆひいては排気空燃比をリッチ空燃比（例えば、値１２程度）とするリッチ空燃比制御を行う（第２運転状態）。これにより、吸蔵型ＮＯx触媒３０が高温にまで昇温させられるとともに還元雰囲気とされて、Ｓパージが開始される。

【００３０】次のステップＳ１６では、吸蔵型ＮＯx触媒３０の温度、即ち触媒温度Ｔcatが Ｓパージに必要な所定温度Ｔcat １（例えば、６５０℃）を超えた（Ｔcat＞Ｔcat1）か否かを判別する。判別結果が偽（Ｎｏ）で、触媒温度Ｔcatが未だ所定温度Ｔcat １（例えば、６５０℃）に達していないような場合には、ステップＳ１２及びステップＳ１４において排気昇温制御とリッチ空燃比制御とを継続実施する。

【００３１】一方、ステップＳ１６の判別結果が真（Ｙｅｓ）で、触媒温度Ｔcatが所定温度Ｔcat １を超えたと判定された場合には、次にステップＳ１８に進む。ステップＳ１８では、吸蔵型ＮＯx触媒３０への排ガス流量を減量する。具体的には、触媒温度Ｔcatが所定温度Ｔcat １を超えたら、ＥＣＵ４０から所定の駆動信号をソレノイド３８に供給し、バイパスバルブ３６を開弁側、即ち排ガスがバイパス通路３４を流れるように操作する（流量減量手段）。このとき、バイパスバルブ３６は、排ガスの大半がバイパス通路３４に流入し、吸蔵型ＮＯx触媒３０へは殆ど流入しないような開度とされる。

【００３２】このように、触媒温度Ｔcatが所定温度Ｔcat １を超えた後、排ガスが殆ど吸蔵型ＮＯx触媒３０を通らないようになると、吸蔵型ＮＯx触媒３０は、バイパスバルブ３６が開弁され吸蔵型ＮＯx触媒３０へ流れる排ガスが減少させられた時点の温度、即ち所定温度Ｔcat １に良好に保持されることになる。一方、Ｓパージは ＳＯxの吸蔵された吸蔵型ＮＯx触媒３０が還元雰囲気にあり且つ所定温度Ｔcat １以上であれば良好に実施されることが実験等により分かっている。つまり、このように吸蔵型ＮＯx触媒３０に流入する排ガスが減少させられたとしても、Ｓパージは良好に継続されるのである。

【００３３】なお、この際、吸蔵型ＮＯx触媒３０は走行風によって冷却されるが、吸蔵型ＮＯx触媒３０の断

熱性は高く、走行風による冷却度合は排ガス流による冷却に比べれば極めて小さい。故に、当該走行風による吸蔵型ＮＯx触媒３０の温度への影響は殆ど無いとみなせ無視できる。そして、次のステップＳ２０では、２段噴射の副噴射量を減量し排気昇温の昇温度合を低下させるようにして排気昇温制御を継続実施する。このように排気昇温の昇温度合を低下させると、排ガスの温度は低下する。しかしながら、上述した如く、バイパスバルブ３６の開弁後は、当該降温した排ガスは殆ど吸蔵型ＮＯx触媒３０へ流れることはなく、吸蔵型ＮＯx触媒３０が不用意に降温してしまうことはない。つまり、吸蔵型ＮＯx触媒３０へ流れる排ガスが減少させられた後にあっては、僅かに吸蔵型ＮＯx触媒３０へ流れる排ガスによる昇温作用の維持を考慮しながら、このように２段噴射の副噴射量を減量して排気昇温制御を実施することもでき、このようにすれば、吸蔵型ＮＯx触媒３０に悪影響を及ぼすことなく燃料消費量を節約でき、燃費の向上を図ることができることになる。

【００３４】また、ステップＳ２２では、リッチ化度合を軽減し、目標Ａ／Ｆひいては排気空燃比をストイキオ寄りにしてリッチ空燃比制御を実施する。Ｓパージを行う際には、吸蔵型ＮＯx触媒３０の温度が所定温度Ｔcat 1を超えていれば、排気空燃比は、リッチ空燃比である限りストイキオ近傍値であってもよいことが実験等により分かっている。また、実際には、吸蔵型ＮＯx触媒３０へ流れる排ガスが減少させられると、吸蔵型ＮＯx触媒３０は、吸蔵型ＮＯx触媒３０へ流れる排ガスが減少した時点のリッチ化度合の高い好適な還元雰囲気のままに暫時保持される。即ち、吸蔵型ＮＯx触媒３０へ流れる排ガスが減少させられた後にあっては、僅かに吸蔵型ＮＯx触媒３０へ流れる排ガスによる還元雰囲気の維持を考慮しながら、このように目標Ａ／ＦをＳパージの開始時点よりもストイキオ寄りの値（例えば、値１４程度）にでき、このようにすれば、やはり燃料消費量を節約でき、燃費の向上を図ることができる。

【００３５】なお、このときバイパス通路３４を流れる排ガスは、排気空燃比がストイキオ近傍となるので、三元触媒３２によって良好に浄化される。ステップＳ２４では、上記のようにして触媒温度Ｔcatが所定温度Ｔcat 1に保持された吸蔵型ＮＯx触媒３０において、Ｓパージが十分に進行し、上記式(1)に基づき、被毒Ｓ量Ｑsが最小値Ｑs0を下回った（Ｑs＜Ｑs0）か否かを判別する。判別結果が偽（Ｎｏ）の場合には、ステップＳ２０及びステップＳ２２において、副噴射量を減量した排気昇温制御とリッチ化度合を軽減したリッチ空燃比制御とをさらに継続して実施する。

【００３６】一方、ステップＳ２４の判別結果が真（Ｙｅｓ）で、被毒Ｓ量Ｑsが最小値Ｑs0を下回ったと判定された場合には、十分にＳパージは実施されたとみなすことができ、この場合には、ステップＳ２６に進み、排

気昇温制御とリッチ空燃比制御とを終了する。そして、さらに、ステップＳ２８において、開弁していたバイパスバルブ３６を閉弁し（図１中に破線で示す状態）、通常通り排ガスの全量が吸蔵型ＮＯx触媒３０へ流れるようにする。これにより、本発明に係る一連のＳパージ制御が完了する。

【００３７】ここで、図３を参照すると、本発明の他の実施形態のフローチャートの一部が示されており、以下当該他の実施形態について説明する。なお、図３には、上記実施形態と異なる部分ついてのみ示されており、ここでは上記実施形態と共通する部分（ステップＳ１０～ステップＳ１６）については説明を省略し、異なる部分についてのみ説明する。

【００３８】上記ステップＳ１６を経てステップＳ１８’では、吸蔵型ＮＯx触媒３０への排ガス流を一切遮断する。つまり、触媒温度Ｔcatが所定温度Ｔcat 1を超えたら、ＥＣＵ４０から所定の駆動信号をソレノイド３８に供給してバイパスバルブ３６を全開とし（図１中に実線で示す状態）、全ての排ガスがバイパス通路３４を流れるように操作する。

【００３９】これにより、吸蔵型ＮＯx触媒３０は、バイパスバルブ３６が全開とされ吸蔵型ＮＯx触媒３０へ流れる排ガスが遮断させられた時点の温度、即ち所定温度Ｔcat 1に確実に保持されることになり、やはりＳパージは良好に継続される。そして、次のステップＳ２０’では、２段噴射を中止し排気昇温制御を中止する。排ガスが一切吸蔵型ＮＯx触媒３０に流れないようにされると、排ガス温度が低下しても吸蔵型ＮＯx触媒３０の温度低下はなく、故にこのように排気昇温制御を中止することもでき、これにより、燃料消費量を通常の運転状態と同様にでき、燃費のさらなる向上を図ることができる。

【００４０】また、ステップＳ２２’では、ストイキオフィードバック（ストイキオＦ／Ｂ）制御を実施する。排ガスが吸蔵型ＮＯx触媒３０に一切流入しないようにされると、排気空燃比がどのような値であっても吸蔵型ＮＯx触媒３０は排ガスの影響を受けず良好に還元雰囲気に維持される。故に、三元触媒３２での浄化能力を考慮しながらこのようにストイキオＦ／Ｂ制御を実施することもでき、これにより、やはり燃料消費量を通常の運転状態と同様にでき、燃費のさらなる向上を図ることができる。

【００４１】なお、このようにストイキオＦ／Ｂ制御を実施するようにすると、その後に吸蔵型ＮＯx触媒３０の温度が所定温度Ｔcat 1を下回ったような場合に、直ぐに排気昇温制御やリッチ空燃比制御に移行できるという利点もある。ステップＳ２４’では、上記ステップＳ２４の場合と同様に、被毒Ｓ量Ｑsが最小値Ｑs0を下回った（Ｑs＜Ｑs0）か否かを判別する。判別結果が偽（Ｎｏ）の場合には、ステップＳ２０’及びステップＳ

２２’を継続して実施する。

【００４２】一方、ステップＳ２４’の判別結果が真（Ｙｅｓ）で、被毒Ｓ量Ｑsが最小値Ｑs0を下回ったと判定された場合には、十分にＳパージは実施されたとみなすことができ、この場合には、ステップＳ２６’に進み、上記排気昇温制御の中止に加えてさらにストイキオＦ／Ｂ制御をも終了する。そして、ステップＳ２８’において、全開していたバイパスバルブ３６を閉弁し（図１中に破線で示す状態）、上記同様に、通常通り排ガスの全量が吸蔵型ＮＯx触媒３０へ流れるようにし、Ｓパージ制御を終了する。

【００４３】ところで、当該他の実施形態では、吸蔵型ＮＯx触媒３０への排ガス流を遮断した後、ストイキオＦ／Ｂ制御を実施するようにしたが、排気空燃比をリーン空燃比に制御するようにしてもよく、この場合には、バイパス通路３４を通る排ガス中のＮＯxの浄化を考慮して、バイパス通路３４の排気管１４への合流部と三元触媒３２との間にさらにＮＯx触媒（例えば、選択還元型ＮＯx触媒）を配設するようにしてもよい。なお、選択還元型ＮＯx触媒は、ＮＯxを常時選択的に浄化可能な触媒である。

【００４４】なお、上記実施形態では、吸蔵型ＮＯx触媒３０を迂回するバイパス通路３４を設け、触媒温度Ｔcatが所定温度Ｔcat 1を超えると該バイパス通路３４に排ガスを流すようにして吸蔵型ＮＯx触媒３０に流入する排ガス流量を減量するようにしたが、これに限られず、例えば、エンジン１がアイドル運転中であったり、或いは、ハイブリッド車（発電機をエンジンで定速回転させて発電するタイプの電気自動車）に使用されるエンジンのように、エンジン出力を一時的に低下させても車両走行に問題がないような状況の場合には、エンジン回転速度を低下させることで排ガス流量を減量するようにしてもよく、また、エンジンを停止させて排ガス流量をゼロにしてもよい（流量減量手段）。

【００４５】また、上記実施形態では、エンジン１を筒内噴射型ガソリンエンジンとしたが、これに限られず、エンジン１は、如何なる形態のエンジンであってもよい。

【００４６】

【発明の効果】以上詳細に説明したように、本発明の請求項１の内燃機関の排気浄化装置によれば、燃費やドライバビリティの悪化を防止しながら、触媒に吸蔵された硫黄成分を効率よく確実に放出することができる。

【図面の簡単な説明】

【図１】本発明に係る内燃機関の排気浄化装置を示す概略構成図である。

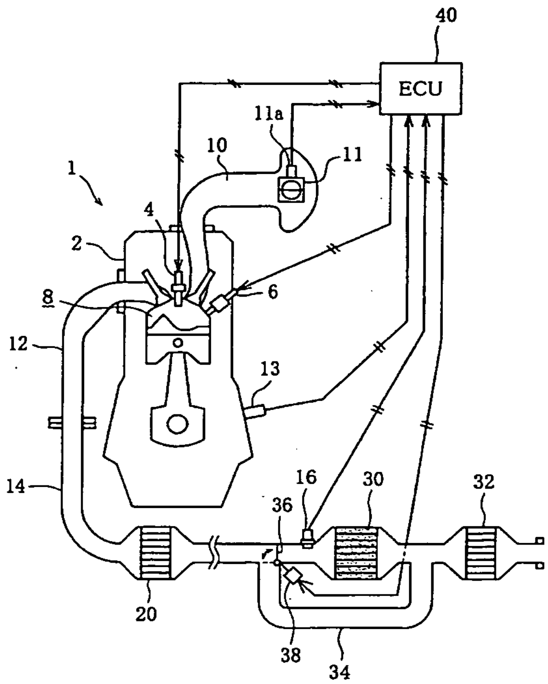
【図２】本発明に係るＳパージ制御の制御ルーチンを示すフローチャートである。

【図３】本発明の他の実施形態に係るＳパージ制御の制御ルーチンを示すフローチャートの一部である。

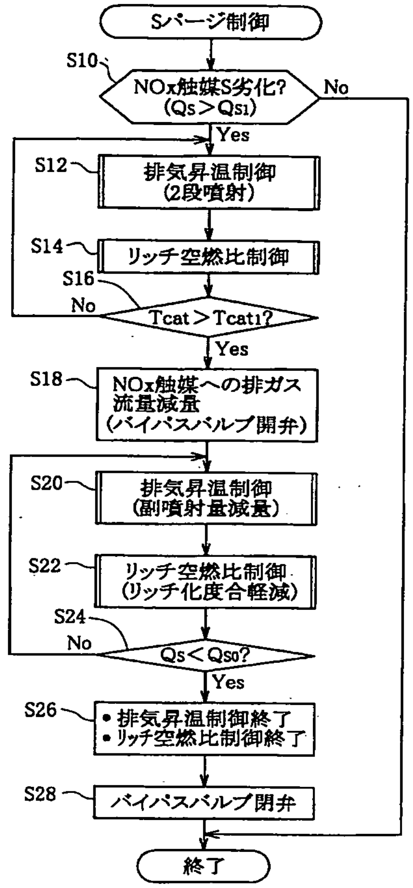
【符号の説明】

１　エンジン（内燃機関）
４　点火プラグ
６　燃料噴射弁
１１　スロットル弁
１１ａ　スロットルポジションセンサ
１３　クランク角センサ
１６　高温センサ
３０　吸蔵型ＮＯx触媒
３２　三元触媒
３４　バイパス通路
３６　バイパスバルブ
３８　ソレノイド
４０　電子コントロールユニット（ＥＣＵ）

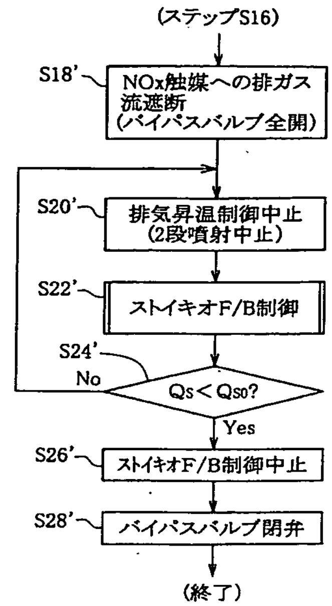
【図１】



【図２】



【図３】



フロントページの続き

(51) Int.Cl.⁷		識別記号	F I		テーマコード(参考)
Ｆ０２Ｄ	41/04	３０５	Ｆ０２Ｄ	43/00	３０１Ｔ
	43/00	３０１	Ｂ０１Ｄ	53/36	ＺＡＢＤ

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Ｆターム(参考)　3G084 AA03 AA04 BA09 BA13 BA15
BA17 BA19 BA24 CA07 DA05
DA10 DA11 DA27 EA11 EB11
EB16 FA10 FA27 FA33 FA38
3G091 AA02 AA12 AA14 AA17 AA24
AA28 AB03 AB05 AB06 BA11
BA14 BA15 BA19 BA33 CA12
CA13 CB02 CB03 CB05 DA01
DA03 DA05 DA08 DB06 DB10
4D048 AA02 CA01 DA01 DA02 DA05
DA06 DA08 DA13 EA04

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-130157
(43)Date of publication of application : 09.05.2000

(51)Int.CI. F01N 3/24
B01D 53/86
F01N 3/08
F01N 3/20
F02D 41/04
F02D 43/00

(21)Application number : 10-303894
(22)Date of filing : 26.10.1998

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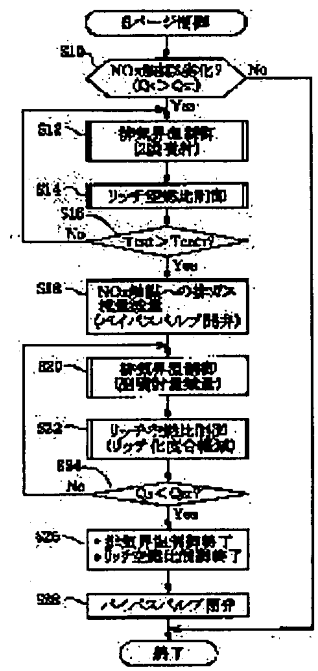
(54) EXHAUST EMISSION CONTROL DEVICE FOR INTERNAL COMBUSTION ENGINE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an exhaust emission control device for an internal combustion engine which can restrain the deterioration of a fuel consumption and drivability and release a sulphur component efficiently and surely.
SOLUTION: This exhaust emission control device for an internal combustion engine is provided in an exhaust gas passage and provided with a catalyst absorbing the sulphur component in an exhaust gas under a first operation state in which an exhaust air fuel ratio is an oxydation atmosphere and releasing the sulphur component absorbed under a second operation state in which a high temperature and exhaust air fuel ratio are a restoration atmosphere. In that device, in a second operation state (S12, S14), the exhaust flow rate poured in the catalyst by a flow rate reduction means is properly reduced (S18). Therefore, even if the exhaust temperature and exhaust air fuel ratio are changed (S20, S22), the catalyst is held in the high temperature and restoration atmosphere.



LEGAL STATUS

[Date of request for examination] 21.04.2005

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The exhaust emission control device of the internal combustion engine which is formed in a flueway, does occlusion of the sulfur component under exhaust air by the 1st operational status from which an exhaust-air air-fuel ratio serves as an oxidizing atmosphere, and is characterized by to have the catalyst which emits said sulfur component which carried out occlusion by the 2nd operational status from which an elevated temperature and an exhaust-air air-fuel ratio serve as reducing atmosphere, and a flow rate loss-in-quantity means decrease the quantity of the exhaust-air flow rate which flows into said catalyst at the time of said 2nd operational status.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to an internal combustion engine's exhaust emission control device, and relates to the technique of removing in detail the sulfur oxide (SOx) by which occlusion was carried out to the catalyst.
[0002]
[A related background technique] Generally, S (sulfas) component (sulfur component) is contained in the fuel, this S component reacts with oxygen, and serves as SOx (sulfur oxide), and occlusion of this SOx is carried out to an exhaust air purification catalyst as sulfate X-SO4 (S poisoning). For example, in the case of an occlusion mold NOx catalyst, when an exhaust air air-fuel ratio is the Lean air-fuel ratio (oxidizing atmosphere), occlusion of the SOx is carried out with NOx in exhaust gas, and there is a problem that the NOx purification function of a catalyst falls.
[0003] Then, when occlusion of the SOx is carried out to an occlusion mold NOx catalyst in this way, the technique (S emission control) which emits the SOx concerned by which occlusion was carried out by making a catalyst into a predetermined elevated temperature by exhaust air temperature up control (for example, retard of ignition timing), and making the exhaust air air-fuel ratio of the catalyst circumference into a rich air-fuel ratio (reducing atmosphere to which the oxygen density fell) is well-known by JP,7-217474,A etc.
[0004]
[Problem(s) to be Solved by the Invention] By the way, with the technique indicated by the above-mentioned official report (JP,7-217474,A), exhaust air temperature up control is continued until SOx by which occlusion was carried out is emitted during S emission control from the need of always holding whenever [catalyst temperature] to the above-mentioned predetermined elevated temperature. However, in order to make the output of internal combustion engine original decline, continuing and continuing exhaust air temperature up control (retard of ignition timing etc.) in this way, at a long period of time leads to aggravation of fuel consumption, and aggravation of drivability, and it is not a desirable thing.
[0005] Then, although it is possible to shorten the operation period of exhaust air temperature up control Since it consists of configurations indicated by the above-mentioned official report so that exhaust gas may always pass along an occlusion mold NOx catalyst, only by cutting down the operation period of exhaust air temperature up control The temperature of exhaust gas falls by termination of exhaust air temperature up control, whenever [catalyst temperature] falls, and there is a problem that whenever [catalyst temperature] cannot be held to an elevated temperature predetermined [above-mentioned] enough. There is a possibility that S emission control may be completed as SOx by which it will be quickly cooled by the flow of a lot of exhaust gas with which the temperature concerned fell under the situation that there are many amounts of emission like an internal combustion engine with large displacement, and occlusion of the catalyst which carried out the temperature up was once carried out even to predetermined temperature is not especially emitted completely by it, and it is not desirable.
[0006] The place which it was made in order that this invention might solve such a trouble, and is made into the purpose is to suppress aggravation of fuel consumption or drivability and offer the exhaust emission control device of the efficient internal combustion engine which can emit a sulfur component certainly.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, according to invention of claim 1, it is prepared in a flueway. In the exhaust emission control device of the internal combustion engine having the catalyst which emits the sulfur component which carried out occlusion of the sulfur component

under exhaust air by the 1st operational status from which an exhaust air air-fuel ratio serves as an oxidizing atmosphere, and carried out occlusion to the bottom of the 2nd operational status from which an elevated temperature and an exhaust air air-fuel ratio serve as reducing atmosphere The exhaust air flow rate which flows into a catalyst with a flow rate loss-in-quantity means is made to reduce one's weight suitably at the time of the 2nd operational status.

[0008] For example, it is made hard to make the exhaust air flow rate which flows into a catalyst reduce one's weight, and to flow for a catalyst, if a catalyst becomes a predetermined elevated temperature after the 2nd operational status is started by exhaust gas. Thus, although an air-fuel ratio will usually be made into a rich air-fuel ratio by the 2nd operational status that the retard of ignition timing etc. is performed that a catalyst should be made an elevated temperature, an exhaust-gas temperature is raised, and an exhaust air air-fuel ratio should be made reducing atmosphere if it is made for exhaust gas to hardly flow for a catalyst Even if it operates it so that the degree of the amount of retard of these ignition timing or a rich air-fuel ratio may be stopped small and the temperature of exhaust gas may be reduced It is almost lost that a catalyst will be cooled, a catalyst is held by the emission of the low temperature concerned to a predetermined elevated temperature for a time at fitness, and an exhaust air air-fuel ratio is held good at reducing atmosphere.

[0009] In this case, although it is in the inclination for the fuel amount of supply to increase by rich air-fuel ratio-ization of an air-fuel ratio, and for fuel consumption and drivability to get worse, in the 2nd operational status while the output of internal combustion engine original declines by the retard of ignition timing etc. Emission becomes it is efficient and certainly possible about the sulfur component by which occlusion was carried out to the catalyst, being able to stop the operating period in the 2nd operational status concerned at the need and sufficient period until a catalyst becomes a predetermined elevated temperature, and preventing aggravation of fuel consumption or drivability.

[0010] Emission becomes it is efficient and certainly possible about the sulfur component by which occlusion was carried out to the catalyst, being able to return an internal combustion engine's operational status to the usual operational status, and preventing aggravation of fuel consumption or drivability much more suitably preferably, if a catalyst becomes a predetermined elevated temperature, it will be good to intercept entirely and it will carry out the exhaust stream which flows into a catalyst in this way, after the 2nd operational status is started.

[0011]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained based on an accompanying drawing. If drawing 1 is referred to, the outline block diagram of the exhaust emission control device of the internal combustion engine concerning this invention carried in the car will be shown, and the configuration of the exhaust emission control device applied to this invention based on this drawing below will be explained.

[0012] Let the engine body (only henceforth an engine) 1 be the injection mold jump-spark-ignition type serial 4-cylinder gasoline engine in a cylinder which can carry out fuel injection (injection mode like an inhalation-of-air line) like an inhalation-of-air line, or fuel injection (compression stroke injection mode) in a compression stroke by switching for example, fuel-injection mode (operation mode). And this injection type in a cylinder of engine 1 is made easy, implementation of operation by theoretical air fuel ratio (SUTOIKIO) or operation (the Lean air-fuel ratio operation) with the Lean air-fuel ratio besides operation (rich air-fuel ratio operation) with a rich air-fuel ratio is enabled, and operation of it with a super-RIN air-fuel ratio is especially enabled in compression stroke injection mode.

[0013] As shown in this drawing, the electromagnetic fuel injection valve 6 is attached in the cylinder head 2 of an engine 1 with the ignition plug 4 for every gas column, and, thereby, direct injection of a fuel is enabled in the combustion chamber 8. And the fuel supply system (not shown [both]) which had the fuel tank through the fuel pipe is connected to the fuel injection valve 6.

[0014] Furthermore, the suction port is formed in the abbreviation erection direction for every gas column, and as open for free passage [with each suction port] to the cylinder head 2, the end of an inlet manifold 10 is connected to it, respectively. And the throttle valve 11 is connected to the other end of an inlet manifold 10, and throttle position sensor (TPS) 11a which detects throttle opening thetath is prepared in this throttle valve 11.

[0015] Moreover, the exhaust air port is formed in the abbreviation horizontal direction for every gas column, and as open for free passage [with each exhaust air port] to the cylinder head 2, the end of an exhaust manifold 12 is connected to it, respectively. The sign 13 in drawing is a crank angle sensor which detects a crank angle, and is made possible [detection of an engine speed Ne] for this crank angle sensor 13.

[0016] In addition, the injection type in a cylinder concerned of engine 1 is well-known, and already omits explanation about the detail of the configuration here. As shown in this drawing, the exhaust pipe (flueway) 14 is connected to the exhaust manifold 12, and the muffler (not shown) is connected to this exhaust pipe 14 through the small contiguity three way component catalyst 20, the occlusion mold NOx catalyst 30, and three way component catalyst 32 close to an engine 1. Moreover, the elevated-temperature sensor 16 which detects an exhaust-gas temperature is formed in the occlusion mold NOx catalyst 30 upstream section of an exhaust pipe 14.
[0017] Moreover, as exhaust gas bypasses the occlusion mold NOx catalyst 30, the bypass path 34 is formed, and the bypass valve 36 of the butterfly type which adjusts the ratio of the amount of emission which flows into the bypass path 34, and the amount of emission which flows into the occlusion mold NOx catalyst 30 is arranged in the tee from the exhaust pipe 14 of the bypass path 34. Closing motion actuation of this bypass valve 36 is enabled by the solenoid 38.
[0018] The occlusion mold NOx catalyst 30 once carries out occlusion of NOx in an oxidizing atmosphere, and has the function to which N2 (nitrogen) etc. is made to return NOx into the reducing atmosphere in which CO mainly exists. In detail, the occlusion mold NOx catalyst 30 is constituted as a catalyst with platinum (Pt), a rhodium (Rh), etc. as noble metals, and alkali metal, such as barium (Ba), and alkaline earth metal are adopted as occlusion material.
[0019] Furthermore, ECU (electronic control unit)40 equipped with an I/O device, storage (ROM, RAM, nonvolatile RAM, etc.), the central processing unit (CPU), the timer counter, etc. is installed, and synthetic control of the exhaust emission control device of the internal combustion engine applied to this invention by this ECU40 is performed. The various sensors of TPS11a and the crank angle sensor 13 which were mentioned above, or elevated-temperature sensor 16 grade are connected to the input side of ECU40, and the detection information from these sensors inputs.
[0020] On the other hand, the ignition plug 4 and fuel injection valve 6 grade which were mentioned above through the ignition coil are connected to the output side of ECU40, and optimum values calculated based on the detection information from various sensors, such as fuel oil consumption and ignition timing, are outputted to these ignition coils and fuel injection valve 6 grade, respectively. A proper quantity of a fuel is injected from a fuel injection valve 6 to proper timing by this, and ignition is carried out to proper timing with an ignition plug 4.
[0021] By the way, in ECU40, based on throttle opening information thetath from TPS11a, and the engine-speed information Ne from the crank angle sensor 13, it enables it to ask for the target cylinder internal pressure Pe corresponding to an engine load, i.e., a target mean effective pressure, and fuel-injection mode is further set up from a map (not shown) according to the target mean effective pressure Pe and the engine-speed information Ne concerned. For example, when both the target mean effective pressure Pe and the engine speed Ne are small, if fuel-injection mode is made into compression stroke injection mode, a fuel is injected by the compression stroke, and the target mean effective pressure Pe becomes large on the other hand or an engine speed Ne becomes large, fuel-injection mode will be made into injection mode like an inhalation-of-air line, and a fuel will be injected like an inhalation-of-air line. There are inhalation-of-air RIN mode made into the Lean air-fuel ratio, SUTOIKIO feedback mode made into theoretical air fuel ratio, and an opening loop mode made into a rich air-fuel ratio in injection mode as an inhalation-of-air line.
[0022] And the target air-fuel ratio (target A/F) which serves as control objectives from the target mean effective pressure Pe and an engine speed Ne is set up, and the fuel oil consumption of the proper amount of above is determined based on this target A/F. From the exhaust-gas-temperature information detected by the above-mentioned elevated-temperature sensor 16, Tcat is presumed whenever [catalyst temperature]. In order to amend the error which originates in the ability of the direct installation of the elevated-temperature sensor 16 not to be carried out at the occlusion mold NOx catalyst 30 in detail, and is generated, according to the target mean effective pressure Pe and the engine-speed information Ne, the temperature-gradient map (not shown) is beforehand defined by experiment etc., and Tcat is presumed based on the temperature-gradient map concerned, exhaust air flow rate information (inhalation air content information), etc. whenever [catalyst temperature].
[0023] The operation which relates to this invention of the exhaust emission control device constituted in this way hereafter is explained. That is, although occlusion also of the SOx is carried out to the occlusion mold NOx catalyst 30 at the time of the Lean air-fuel ratio operation (the 1st operational status) as mentioned above, and S (sulfas) purge control (S emission control) removes the SOx concerned for it, S purge control concerning this invention is explained hereafter.
[0024] If drawing 2 is referred to, the flow chart of S purge control routine concerning this invention will be

shown, and it will explain along with the flow chart concerned below. First, at step S10, it distinguishes whether it is that the amount (the amount Qs of poisoning S) of SOx by which occlusion was carried out to whether the NOx catalyst did S (sulfas) degradation of and the occlusion mold NOx catalyst 30 is larger (Qs>Qs1) than the specified quantity Qs1. It is the value with which the amount Qs of poisoning S is calculated here by presumption. Hereafter, the presumed technique of the amount Qs of poisoning S is explained briefly.

[0025] The amount Qs of poisoning S is fundamentally set up based on the amount Qf of fuel-injection addition, and is calculated by the degree type for every execution cycle of a fuel-injection control routine (not shown).

Qs=Qs(n-1)+deltaQf-K-Rs -- (1) Qs (n-1) is the last value of the amount of poisoning S, in deltaQf, the amount of fuel-injection addition per execution cycle and K show a correction factor, and Rs shows the amount of emission S per execution cycle here.

[0026] That is, the present amount Qs of poisoning S is calculated by subtracting the amount Rs of emission S per execution cycle from this addition value while it amends and integrates amount of fuel-injection addition deltaQf per execution cycle with a correction factor K. The correction factor K consists of a product of three correction factors of S poisoning multiplier K3 according to Tcat whenever [S poisoning multiplier / according to air-fuel ratio A/F / K1, S poisoning multiplier / according to S content in a fuel / K2, and catalyst temperature], as shown in a degree type (2).

[0027] K=K1, K2, and K3 -- (2) -- the amount Rs of emission S per execution cycle is calculated from a degree type (3) again.

Rs=alpha-R 1, R2, dT -- (3) alpha is a rate of emission per unit time amount (set point), dT shows the execution cycle of a fuel-injection control routine here, and R1 and R2 show the emission capacity multiplier according to Tcat, and the emission capacity multiplier according to air-fuel ratio A/F to it whenever [catalyst temperature], respectively.

[0028] Since it is not necessary to perform S purge when the distinction result of step S10 is a false (No), it escapes from the routine concerned, without doing anything. On the other hand, by truth (Yes), when the amount Qs of poisoning S is judged as having exceeded the specified quantity Qs1 and the NOx catalyst having done S degradation of, a distinction result progresses to step S12 next, and starts S purge. At step S12, exhaust air temperature up control is performed in order to carry out the temperature up of the occlusion mold NOx catalyst 30 (the 2nd operational status). In fact, two-step injection (multiple-times injection) is performed here. That is, while an inhalation-of-air line performs the main injection of the main combustion into a compression stroke, an expansion line performs subinjection to inside, performs an exhaust air temperature up by burning the unburnt fuel components (HC etc.) by subinjection within an exhaust pipe 14 with the heat of exhaust gas, and is made to carry out the temperature up of the occlusion mold NOx catalyst 30. In addition, this exhaust air temperature up control may be the retard of ignition timing, as mentioned above, and the temperature up effectiveness as two-step injection that the retard of ignition timing is also the same is acquired. Moreover, you may make it use together the retard of two-step injection and ignition timing.

[0029] And at the following step S14, rich Air Fuel Ratio Control which makes target A/F, as a result an exhaust air air-fuel ratio a rich air-fuel ratio (for example, about 12 value) is performed that the occlusion mold NOx catalyst 30 should be made the reducing atmosphere to which the oxygen density fell (the 2nd operational status). By this, while the occlusion mold NOx catalyst 30 is made to carry out a temperature up even to an elevated temperature, it considers as reducing atmosphere, and S purge is started.

[0030] At the following step S16, Tcat distinguishes whether it is having exceeded the predetermined temperature Tcat 1 (for example, 650 degrees C) required for S purge (Tcat>Tcat1) whenever [temperature / of the occlusion mold NOx catalyst 30 /, i.e., catalyst temperature,]. In a false (No), a distinction result implements exhaust air temperature up control and rich Air Fuel Ratio Control continuously in step S12 and step S14, when Tcat has not yet reached the predetermined temperature Tcat 1 (for example, 650 degrees C) whenever [catalyst temperature].

[0031] On the other hand, the distinction result of step S16 progresses to step S18 next, when it judges that Tcat exceeded the predetermined temperature Tcat 1 whenever [catalyst temperature] by truth (Yes). At step S18, the quantity of the amount of emission to the occlusion mold NOx catalyst 30 is decreased. If Tcat exceeds the predetermined temperature Tcat 1 whenever [catalyst temperature], a predetermined driving signal will be supplied to a solenoid 38 from ECU40, and specifically, it will be operated so that exhaust gas may flow the bypass path 34 a bypass valve 36 valve-opening-side (flow rate loss-in-quantity means). Let a bypass valve 36 be the opening by which the great portion of exhaust gas flows into the bypass path 34, and

it hardly flows into the occlusion mold NOx catalyst 30 at this time.
[0032] Thus, after Tcat exceeds the predetermined temperature Tcat 1 whenever [catalyst temperature], when exhaust gas almost ceases to pass along the occlusion mold NOx catalyst 30, the occlusion mold NOx catalyst 30 will be held good at the temperature Tcat 1 at the time of the exhaust gas which a bypass valve 36 is opened and flows to the occlusion mold NOx catalyst 30 being decreased, i.e., predetermined temperature. on the other hand, if S purge has the occlusion mold NOx catalyst 30 to which occlusion of the SOx was carried out in reducing atmosphere and it comes out one or more predetermined temperature Tcat, it is understood that it carries out good by experiment etc. That is, even if the exhaust gas which flows into the occlusion mold NOx catalyst 30 in this way was decreased, S purge is continued good.
[0033] In addition, in this case, although therefore cooled in the style of transit, the occlusion mold NOx catalyst 30 is high, and if it is compared with cooling by emission, it is very small [the catalyst / the cooling degree depended in the style of transit]. [of adiathermic / of the occlusion mold NOx catalyst 30] Therefore, it can consider that most effects of the temperature on the occlusion mold NOx catalyst 30 concerned depended in the style of transit cannot be found, and can ignore. And at the following step S20, as the quantity of the subinjection quantity of two-step injection is decreased and the temperature up degree of an exhaust air temperature up is reduced, exhaust air temperature up control is implemented continuously. Thus, if the temperature up degree of an exhaust air temperature up is reduced, the temperature of exhaust gas will fall. However, as mentioned above, the lowered exhaust gas concerned hardly flows to the occlusion mold NOx catalyst 30, and the occlusion mold NOx catalyst 30 does not lower after valve opening of a bypass valve 36 carelessly. That is, if the quantity of the subinjection quantity of two-step injection can be decreased in this way, exhaust air temperature up control can also be carried out and it does in this way, taking into consideration maintenance of the temperature up operation by the exhaust gas which flows to the occlusion mold NOx catalyst 30 slightly if it is after the exhaust gas which flows to the occlusion mold NOx catalyst 30 is decreased, fuel consumption can be saved without having a bad influence on the occlusion mold NOx catalyst 30, and improvement in fuel consumption can be aimed at.
[0034] Moreover, at step S22, a rich-ized degree is mitigated, target A/F, as a result an exhaust air air-fuel ratio are made into SUTOIKIO approach, and rich Air Fuel Ratio Control is carried out. If the temperature of the occlusion mold NOx catalyst 30 is over the predetermined temperature Tcat 1 in case S purge is performed, as long as it is a rich air-fuel ratio, the experiment etc. shows that an exhaust air air-fuel ratio may be a value near SUTOIKIO. Moreover, if the exhaust gas which flows to the occlusion mold NOx catalyst 30 is decreased in fact, the occlusion mold NOx catalyst 30 will be held for a time as it is the suitable high reducing atmosphere of the rich-ized degree at the time of the exhaust gas which flows to the occlusion mold NOx catalyst 30 decreasing. That is, if target A/F is made to the value (for example, about 14 value) of SUTOIKIO approach and is carried out in this way rather than the initiation time of S purge, taking into consideration maintenance of the reducing atmosphere by the exhaust gas which flows to the occlusion mold NOx catalyst 30 slightly if it is after the exhaust gas which flows to the occlusion mold NOx catalyst 30 is decreased, fuel consumption can be saved too and improvement in fuel consumption can be aimed at.
[0035] In addition, since an exhaust air air-fuel ratio becomes near SUTOIKIO, the exhaust gas which flows the bypass path 34 at this time is purified by the three way component catalyst 32 good. At step S24, in the occlusion mold NOx catalyst 30 with which Tcat was held whenever [catalyst temperature] as mentioned above at the predetermined temperature Tcat 1, S purge fully advances and distinguishes whether it is that the amount Qs of poisoning S was less than the minimum value Qs0 (Qs<Qs0) based on the above-mentioned formula (1). When a distinction result is a false (No), in step S20 and step S22, it continues further and the exhaust air temperature up control which decreased the quantity of the subinjection quantity, and rich Air Fuel Ratio Control which mitigated the rich-ized degree are carried out.
[0036] On the other hand, by truth (Yes), when it judges that the amount Qs of poisoning S was less than the minimum value Qs0, it can consider that S purge was carried out in 10 minutes, and in this case, the distinction result of step S24 progresses to step S26, and ends exhaust air temperature up control and rich Air Fuel Ratio Control. and the bypass valve 36 which was opening in step S28 further -- closing the valve (condition shown with a broken line in drawing 1) -- usually -- a passage -- exhaust gas -- it is made for the whole quantity to flow to the occlusion mold NOx catalyst 30 Thereby, a series of S purge control concerning this invention is completed.
[0037] Here, if drawing 3 is referred to, a part of flow chart of other operation gestalten of this invention will be shown, and the operation gestalt of these these others will be explained below. In addition, it is shown only by attaching by the different section from the above-mentioned operation gestalt, and about the

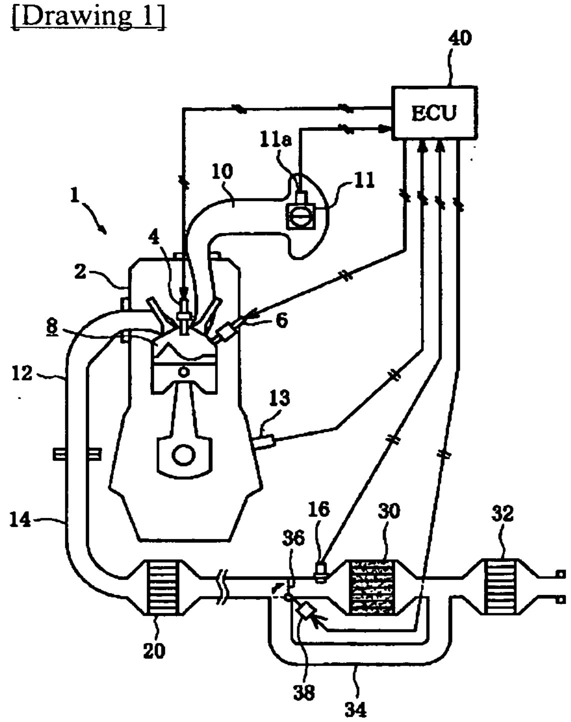
part (step S10 - step S16) which is common in the above-mentioned operation gestalt here, explanation is omitted to drawing 3 , and only a different part is explained to it.
[0038] By step S18', the emission to the occlusion mold NOx catalyst 30 is entirely intercepted through the above-mentioned step S16. That is, if Tcat exceeds the predetermined temperature Tcat 1 whenever [catalyst temperature], a predetermined driving signal will be supplied to a solenoid 38 from ECU40, and a bypass valve 36 will be considered as full open (condition shown as a continuous line in drawing 1), and it will be operated so that all exhaust gas may flow the bypass path 34.
[0039] Thereby, it will be held certainly and S purge is too continued by the temperature Tcat 1 at the time of the exhaust gas which a bypass valve 36 is considered as full open, and flows to the occlusion mold NOx catalyst 30 being made to intercept the occlusion mold NOx catalyst 30, i.e., predetermined temperature, good. And two-step injection is stopped by following step S20', and exhaust air temperature up control is stopped by it. If it is made for exhaust gas not to flow for the occlusion mold NOx catalyst 30 at all, even if exhaust gas temperature falls, there is no temperature fall of the occlusion mold NOx catalyst 30, therefore it can also stop exhaust air temperature up control in this way, thereby, can make fuel consumption be the same as that of the usual operational status, and can aim at further improvement in fuel consumption.
[0040] Moreover, SUTOIKIO feedback (SUTOIKIO F/B) control is carried out in step S22'. If it is made for exhaust gas not to flow into the occlusion mold NOx catalyst 30 at all, no matter an exhaust air air-fuel ratio may be what value, the occlusion mold NOx catalyst 30 will not be influenced of exhaust gas, but will be maintained by reducing atmosphere good. Therefore, SUTOIKIO F/B control can also be carried out in this way, taking into consideration the purification capacity in a three way component catalyst 32, thereby, fuel consumption can be too made to be the same as that of the usual operational status, and further improvement in fuel consumption can be aimed at.
[0041] In addition, when it was made to carry out SUTOIKIO F/B control in this way and the temperature of the occlusion mold NOx catalyst 30 is less than the predetermined temperature Tcat 1 after that, there is also an advantage that it can shift to exhaust air temperature up control or rich Air Fuel Ratio Control immediately. In step S24', the amount Qs of poisoning S distinguishes whether it is were less than the minimum value Qs0 ($Qs<Qs0$) like the case of the above-mentioned step S24. When a distinction result is a false (No), step S20' and step S22' are continued and carried out.
[0042] On the other hand, by truth (Yes), when it judges that the amount Qs of poisoning S was less than the minimum value Qs0, it can consider that S purge was carried out in 10 minutes, and in this case, the distinction result of step S24' progresses to step S26', and, in addition to the termination of the above-mentioned exhaust air temperature up control, also ends SUTOIKIO F/B control further. And in step S28', like the above, the fully opened bypass valve 36 is closed (condition shown with a broken line in drawing 1 R> 1), it usually passes, and it is made for the whole quantity of exhaust gas to flow to the occlusion mold NOx catalyst 30, and it ends S purge control.
[0043] by the way -- being concerned -- others, although it was made to carry out SUTOIKIO F/B control with the operation gestalt after intercepting the emission to the occlusion mold NOx catalyst 30 You may make it control an exhaust air air-fuel ratio to the Lean air-fuel ratio. In this case You may make it arrange an NOx catalyst (for example, selection reduction type NOx catalyst) further in consideration of purification of NOx in the exhaust gas passing through the bypass path 34 between the unification section to the exhaust pipe 14 of the bypass path 34, and a three way component catalyst 32. In addition, a selection reduction type NOx catalyst is always a catalyst which can be purified alternatively about NOx.
[0044] In addition, although the quantity of the amount of emission which flows into the occlusion mold NOx catalyst 30 as passes exhaust gas to this bypass path 34 was decreased with the above-mentioned operation gestalt when the bypass path 34 which bypasses the occlusion mold NOx catalyst 30 was formed and Tcat exceeded the predetermined temperature Tcat 1 whenever [catalyst temperature] It is not restricted to this. An engine 1 is [idle] under operation, or Like the engine used for a hybrid car (electric vehicle of the type which is made to carry out fixed-speed rotation and generates a generator with an engine) Even if it reduces engine power temporarily, when it is in a situation which does not have a problem in car transit, you may make it decrease the quantity of the amount of emission by reducing an engine speed, and an engine may be stopped, and the amount of emission may be made into zero (flow rate loss-in-quantity means).
[0045] Moreover, although the engine 1 was used as the injection mold gasoline engine in a cylinder with the above-mentioned operation gestalt, it may not be restricted to this but an engine 1 may be an engine of what kind of gestalt.
[0046]

[Effect of the Invention] As explained to the detail above, according to the exhaust emission control device of the internal combustion engine of claim 1 of this invention, the sulfur component by which occlusion was carried out to the catalyst can be emitted certainly efficiently, preventing aggravation of fuel consumption or drivability.

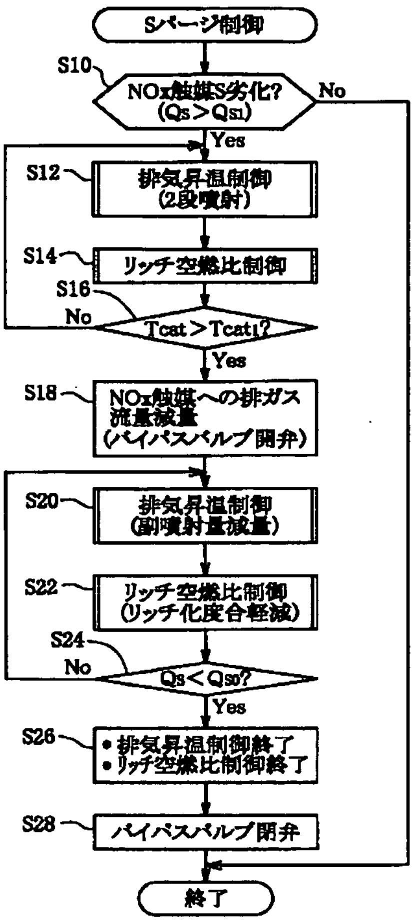
[Translation done.]

DRAWINGS

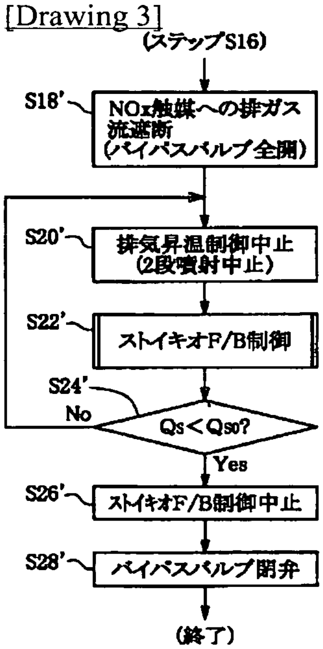
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]